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1. Title of the Invention: Air sterilization and purification apparatus
2. Inventor: Kiyoshi ANZAI
   Domicile: 1070-2 Kataoka, Hiratsuka-shi, Kanagawa-ken
3. Applicant: Director: Kiyoshi ANZAI
   Domicile: Kyowa Seiko, Ltd.
   1070-2 Kataoka, Hiratsuka-shi, Kanagawa-ken
4. Agent: Hiraki MIURA (4002) Patent Attorney [seal]
   Domicile: Marukin Building, Kagurazaka, Shinjuku-ku Tokyo 162
5. List of Appended Documents
   (1) Specification 1 set
   (2) Drawings 1 set
   (3) Duplicate Copy of Application 1 set
   (4) Power of Attorney 1 set Method Examination
   (5) Request for Examination 1 set

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Specification

1. Name of the Invention: Air Sterilization and Purification Apparatus

2. Scope of Patent Claims

In an air purification apparatus that passes positively charged airborne dust between opposing electrodes, an air sterilization and purification apparatus wherein air is caused to pass through while inducing a separation phenomenon by switching the direction of flow of air that passes through the aforementioned opposing electrodes and modifying a cross section of the passage.

3. Detailed Description of the Invention

The invention of the present application is one that relates to an air sterilization and purification apparatus, and in a purification device that causes airborne dust particles to be absorbed by static electricity, relates to a device capable of raising dust removal effectiveness, and is intended to achieve an air sterilization and purification apparatus that, in particular, is made up of a combination of novel and ever simpler elements, is manufactured by a simple process with lower costs of production, and that, with excellent safety, is capable of achieving even better results in use.

Along with the development of heavy industry, air pollution from sources at each stage of the production process, nitrous oxide and sulfur dioxide emitted from transportation sources, and heavy metal particulates, have steadily increased. The widespread expansion of pollution has become an issue of serious concern to society, and various regulations have been proposed to prevent pollution, including preventing the generation of toxic materials as well as the strengthening of emissions standards. These approaches, however, cannot be considered adequate, and there are a growing number of people who suffer from lung cancer and other cancers as well as an increase in the number of people suffering from asthma. Air purifiers have become a common and indispensable part of life and are to be found installed in homes and sickrooms to prevent and/or treat these illnesses, and are used as prevention or treatment devices in the production stages of sanitary pharmaceuticals, foods, devices, and are also employed in the production of precision machinery.

A variety of devices have been suggested to cleanse the air by removing airborne toxic materials. Among those are air purifiers that use filter materials in air flow passageways to physically collect the dust, or electrical air purification devices such as dust removers that make use of static electricity or infrared rays to disinfect the air, or a combination of any of these approaches in order to remove toxic materials.

Among these, suggestions for conventional devices based on the aforementioned use of static electricity are known, including, for example, (a) an approach utilizing centrifugal force designed such that air, induced from an air inlet, passes through an ionization element while electrical voltage is applied to the inner and outer cylinders while the inner cylinder rotates, moving the air between the inner and outer cylinders, and (b) an approach where, in the above configuration, the outer circumference of an inner cylinder has inclined guide vanes provided in the axial direction along the outer circumference of the inner cylinder and rotational movement is applied to the air as it passes through between the inner and outer cylinders to make use of centrifugal force.

The above mentioned approaches have attempted combined dust collection by the use of electrostatic migration and centrifugal force, however, because high voltages with 11 KV in between the inner and outer cylinders, and as a result of rotating the induced air, a rectified electricity may be generated due to frictional resistance depending upon the air flow rate, and electric discharge sparks may occur between the dust particles that have collected onto the external cylinder, frequently causing risk of electrocution as well as the increased production of ozone and possible malfunction of the device.

In view of the above, research conducted by the inventors of the present application have overcome and eliminated the well known defects described above, and have perfected a device that is superior in terms of safety and that markedly increases the efficiency with which dust is adsorbed. The invention comprises a fan motor; an inner cylindrical electrode that has a

built-in high-voltage transformer, and that is connected to the positive side; a high voltage cap connected to the negative side; an external cylindrical electrode that is earthed; and a housing that has openings on both sides, and that is supported by a pedestal. On occasion that airborne dust that is guided into the unit through the upper inlet passes through an ionization section high-voltage cap that is connected on the negative side, a positive charge is applied to the dust, and it is guided into the electrostatic field between the grounded outer cylindrical electrode and the positive inner cylindrical electrode, and as a result of the electrostatic induction effect, airborne dust passing through is adsorbed onto the surface of the outer cylindrical electrode. Thus, the present invention is characterized by having opposing electrodes that have a plurality of parallel curved surfaces and a plurality of convex curved surfaces or recessed curved surfaces on the inner cylinder and an outer cylinder provided with a plurality of parallel curved surfaces and a plurality of convex curved surfaces or recessed surfaces, wherein the convex curved surfaces or recessed surfaces of the inner cylinder and the convex surfaces or recessed surfaces of the outer cylinder alternate with each other. By creating an electrostatic field between these opposing cylinders, the direction of the flow of air passing through them can be alternated, and the flow passageway cross section can be altered so that the flow rate fluctuates, thereby creating a flow separation phenomenon. This causes the generation of a stagnant flow, a reverse flow, or a turbulent flow of air that contains dust. The intention here is to extend the duration of the effect of the electrostatic adsorption on the outer cylindrical electrode surface and to increase in the efficiency of dust removal. The next object of this invention is to provide a device with superior safety. Additionally, an object of the invention is to provide a simple and compact mechanism that can be made available at low cost and that can be placed easily in a variety of locations, as well as to provide a device that allows simple, easy, and safe cleaning of the panel upon which the dust has been adsorbed. Other objects and characteristics of the present invention can be understood. from the following explanation.

In Figs. 1 through 5, a housing acceptor cylinder (5) is supported on a stand (1) by means of a shaft (2) upon which a support board (4) consisting of insulating material and provided with exhaust windows (3); an external cylinder accepting cylinder (7) is mounted on the edge of the lower opening section of said housing; an exhaust windows (6') is arranged in the external cylinder barrel (7); and a fan motor (8) is internally installed in a motor cap (9). The fan motor (8) (for practical purposes, preferably with a maximum torque of $1040 \pm 10\%$) is connected to a power source, and the motor cap (9) has a built-in high-voltage transformer (11) that is connected to a power source. An inner tube electrode (14) made of metal and provided with stepwise alternating vertical curved surfaces (12) and convex curved surfaces (13) is installed onto the positive side of the high-voltage transformer, and a rounded-head inner cap (16) made of insulating material and continuing the multiple outer cylinder support [illegible] (15), (15) is mounted in the top opening of this inner cylindrical electrode (14). A metallic high voltage cap (18) that is provided with a limit switch (17) is installed in this cap (16) and connected to the negative side of the high-voltage transformer and a metallic outer cylindrical electrode (22) provided with stepwise alternating vertical curved surfaces (20) and recessed curved surfaces (21) on the upper opening edge step section (19) of the outer cylinder acceptor (7). The vertical arced surfaces (20) and the recessed arced surfaces (21) are positioned so as to face the swelling arced surfaces (12) on the inner cylindrical electrode (14) and the vertical arced surfaces (12) on the inner cylindrical electrode (14) with each other, respectively. The external cylindrical electrode (22) faces the inner cylindrical electrode (14). According to FIG. 1, an air inlet window (23) is arranged in the upper opening of the external cylindrical electrode (22), and a retainer plate (25) made of insulating material is provided on the bottom limit switch retainer element (24). Next,

the housing (27) is installed on the upper opening of the outer perimeter section (26) of the housing acceptor cylinder (5), which is installed on the support board (4). A head section retaining cylinder (28) is installed at the top section of this opening, and an air inlet window (29) is provided in this upper opening and a connector board (31) made of insulating material and provided with dust-proof mesh/screen (30) that is connected by means of bolts (32) to the retainer plate (25), air inlet windows (29), and air inlet windows (23), and is configured so that air passes between the inner and outer electrodes, the exhaust windows (6), and the exhaust windows (3), and is circulated to the outside when the fan motor (8) is operating.

At this time, when the high voltage transformer (11) and power source are connected by a switch, which is separately arranged (in practical terms, an input voltage of 100 V AC and output voltage of 7 KV DC are preferable) the airborne dust that is introduced [into the unit] is positively charged in the vicinity of the transformer (11), by the inner cylindrical electrode (14) that has been connected to the positive side by means of the electrostatic induction between the inner and outer electrodes, and is migrated to the external cylindrical electrodes (22) and clung to its walls.

Here, the direction of the air flow that is passing through the convex curved surfaces (12) and vertical curved surfaces (13) provided on the inner cylindrical electrode (14) is switched by the vertical curved surfaces (20) and recessed curved surfaces (21) provided on the outer cylindrical electrodes (22), and as a result of the change in the cross section layer between these electrodes, the spacing between the vertical curved surfaces (12), (20) of both electrodes should be approximately 20 mm; the spacing between the vertical curved surfaces (21) on the outer cylindrical electrodes (22) and the convex surfaces (13) on the inner cylindrical electrodes (14) should be approximately 16 mm; and the spacing between the recessed curved surfaces (21) on the outer cylindrical electrodes (22) and the vertical curved surfaces (12) on the inner cylindrical electrode (14) should be approximately 25 mm, for practical purposes. The recessed curved surfaces (21) should be 5 mm in diameter, while the convex curved surfaces (13) should be 4 mm in diameter. There is a change in flow rate, and the separation phenomenon is augmented. As a result, the dust-bearing air flow stagnates, reverses or becomes turbulent, thereby extending the duration for electrostatic adsorption and increasing dust collection efficiency (Fig. 6).

In the cross sectional configuration of the above mentioned both electrodes described above, in another embodiment, the convex curved surfaces (13) of the inner cylindrical electrodes (14) could have a gentle linear flow [illegible] convex curved surfaces (13) on the upstream side to intensify the switching of the direction of flow and the change in the flow passageway cross section, making it that much easier for the separation phenomenon to occur, forming lead (33) between the convex curved surfaces (13), (13) for a configuration that augments electrostatic induction. (Fig. 7)

Moreover, as a separate embodiment, convex curved surfaces (34) with gentle flow lines are formed on the upstream side of the outer cylindrical electrodes (22), and both flow line convex curved surfaces (34) and flow line convex curved surfaces (35) are positioned so they oppose one another, thereby intensifying the switching of the direction of flow and the change in the flow passageway cross section, extending the duration in which adsorption occurs due to stagnation, reverse flow, and turbulent flow of the dust-containing air (Fig. 8).

With regard to removal of dust clung onto the surfaces of the outer cylindrical electrodes, the power to electrode (22) is removed along with the retainer plate (25) by removing the connector board (31) and by pulling up and removing the head section retaining cylinder (28) and the housing (27), and after cleaning these, it is easy to restore them to their original state and join together. At this time, the retainer element (24) of the retainer plate (25) is separated from the limit switch

(17), thereby breaking off the flow of current between the high-voltage transformer (11) and the power source, so that there is no risk of electrocution.

As configured above, the present invention extends the duration of the cling effect on the outer cylindrical electrode by means of electrostatic induction of the dust-carrying air that passes between the electrodes, thereby increasing the efficiency of dust removal and reducing mold spores and yeast fungus.

Moreover, this is a particularly safe device since there is no danger that frictional force and resulting rectified electricity will be generated as a result of centrifugal force as the air passes through the unit, and the risk of malfunction due to sparking electric discharge between the adsorbed dust particles resulting in electrocution or explosion can be prevented, and the generation of ozone can be suppressed.

Also, given the device's simple and compact configuration, it can be manufactured less expensively, and it is also easy to move.

4. Brief Description of the Drawings

Figure 1 is a front view. Figure 2 is a plan view. Figure 3 is a view of the bottom surface. Figure 4 is a cross-sectional view along the A-A line in Figure 1. Figure 5 is a cross-sectional view along the B-B line in Figure 1. Figure 6 is an enlarged view of the area indicated by the letter E in Figure 4. Figure 7 is an enlarged flow line cross section diagram of another embodiment. Figure 8 is an enlarged flow line cross section diagram of yet another embodiment.

Applicant: Kyowa Seiko, Ltd.
Agent: Hiraki MIURA [seal]

(4)

(19)日本国特許庁

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昭和50年2月6日

特許庁長官 [illegible] 殿

1. 発明の名称 [illegible]

2. 発明者
住所 [illegible]
氏名 [illegible]

3. 特許出願人
住所 [illegible]
氏名 [illegible]
代表取締役 [illegible]

4. 代理人 〒102
住所 [illegible]
(6402) 弁理士 [illegible]
電話 [illegible]

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明 細 書

1. 発明の名称 空気清浄装置

2. 特許請求の範囲

空気を吸入する吸入口と、吸入された空気を排出する排出口とを有する本体と、この本体内に設けられ、前記吸入口から吸入された空気を前記排出口から排出するまでの間に通過する空気通路と、この空気通路を通過する空気を帯電させる帯電手段と、この帯電手段により帯電された空気を集塵する集塵手段とを備えた空気清浄装置において、

前記集塵手段は、前記空気通路を通過する空気の流れ方向に対して直交する方向に配置された複数の集塵電極と、これら集塵電極の前記空気通路を通過する空気の流れ方向の上流側および下流側にそれぞれ配置された複数の補助電極とを有し、

前記集塵電極と前記補助電極とは、前記空気通路を通過する空気の流れ方向に対して直交する方向に交互に配置されていることを特徴とする空気清浄装置。

3. 発明の詳細な説明

この発明は、空気清浄装置に関し、特に、空気中のほこりを静電気により吸着させるようにした電気集塵式の空気清浄装置に関する。

従来、この種の空気清浄装置としては、空気中のほこりを静電気により吸着させるようにした電気集塵式のものが知られている。

この電気集塵式の空気清浄装置は、空気中のほこりを帯電させる帯電手段と、この帯電手段により帯電されたほこりを集塵する集塵手段とを備えている。

この集塵手段は、一般に、空気の流れ方向に対して直交する方向に配置された複数の集塵電極と、これら集塵電極の空気の流れ方向の上流側および下流側にそれぞれ配置された複数の補助電極とを有している。

そして、集塵電極と補助電極とは、空気の流れ方向に対して直交する方向に交互に配置されている。

合せ割合によって有害物質を除去せんとする提案がなされている。

従来、上記分離装置に於ける技術の例では、例えば、(1)、空気入口から導入された空気が装置壁を沿って、[illegible]的に旋回を[illegible]された[illegible]を、内筒の周りを旋回しながら通過するようにした遠心力を利用する装置、(2)、上記の装置において、内筒の外周壁に沿って[illegible]した[illegible]を備え、空気がこの内外筒間の空間を通過する際に旋回運動を与えられるようにした遠心力を利用する装置が知られている。

上記の装置は、[illegible]の[illegible]力と遠心力との[illegible]作用を[illegible]ったものであるが、[illegible]

[illegible]

3

[illegible]

4

[illegible]

5

[illegible]

6

特開 昭51-90077 (3)

は、円柱マンプ(21)の内周において上の開口部に内接され、円外周電極(24)において内周電極(23)との間に絶縁した円柱状電極(24)に反発され外周電極(23)に吸引されその位置に保持される。

との間、円周電極(24)に設けた突起部電極(25)と電極底面(28)とが、外周電極(22)に設けた凹部(29)と凹部底面(27)とによって、空気の流通する最短の方向が確保されるようになっており、その円柱状の部分(円柱状に成形電極の凹部底面(27)と、外周電極(22)の段状底面(34)との間隔が2.0%、外周電極(22)と円周電極(24)の電極底面(25)との間隔が2.0%、外周電極(22)と円周電極(24)の電極底面(28)との間隔を約2.0%とすると、円その凹部底面(27)は5%程、電極底面(25)は4%程とすることが望ましい。この実施によって放電が安定し、放れの開始電圧を約半分の値とでき、これによって合成状態の放れの防ぎ、空気中の微粒子を確実に除去する外周電極間の有効放電作用時間を長く保ち放電効率を向上させることができる。(次ページ)

6

のもので同様部品である。この成形電極(26)の内周面(24)がリセットスイッチ(30)と接触し、再度トランス(33)と電源との接続を断つので、放電の一つずれも生じない。

本発明の説明は、上記の実施例によるので、外周電極を通過する合成空気中の微粒子の静電によって外周電極間に放電作用時間を延長するので、その効果効率を向上させるその他の効果、経済的効果の数々を期待することができる。

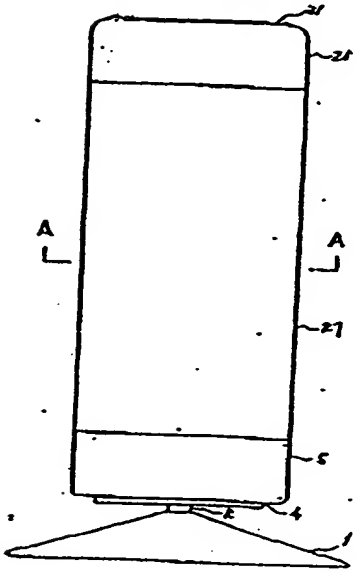
又、通過中の空気は、放心力によって放射状に放れる電荷電気の発生のおそれなく、よって放電されたふんじんとの間に火花放電に起因する感電において放電部の両面を非常に静止することができ、又オゾンの発生を減少することとともでも安全快に使用出来る。

さらに構造非常簡単小形であるので資本を工程とより良い空気を以て提供されかつ経済的である。

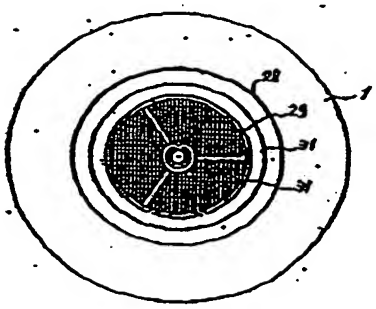
4、図面の簡単な説明

第1図は正面図、第2図は平面図、第3図は底

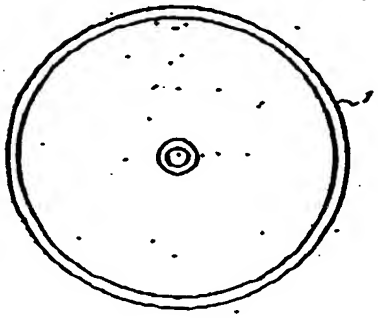
第 1 図



第 2 図



第 3 図



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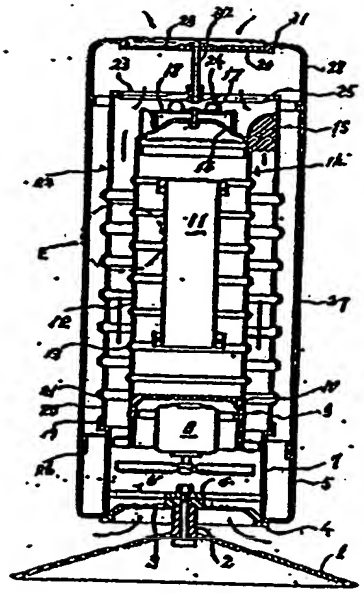
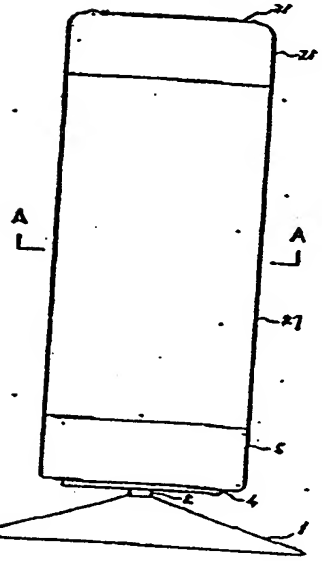


図面、第1図は第2図A－A線における断面図、第2図は第1図B－B線における底面図、第3図は第1図C－C線における同じく底面図、第4図は第1図D－D線における同じく断面図である。

代理人　三浦　邦

特開 昭51－90077 (4)

第 1 図



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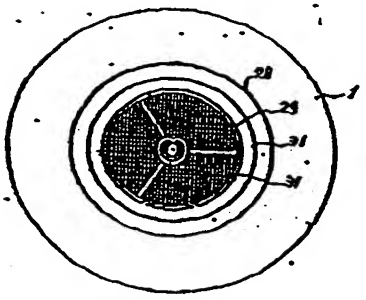
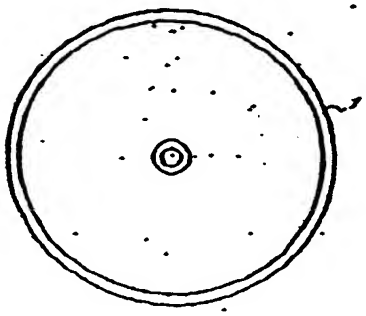


第 3 図



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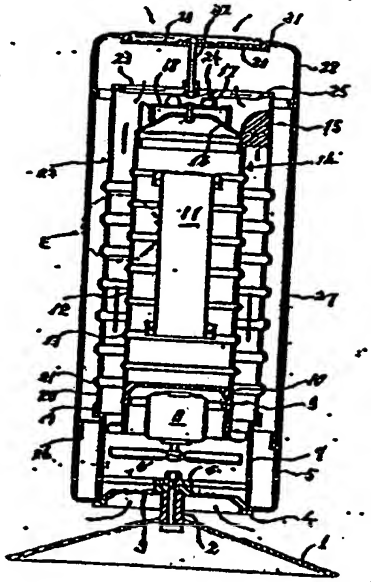

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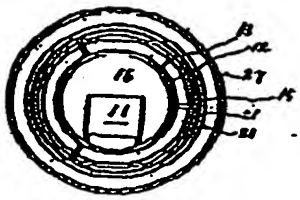

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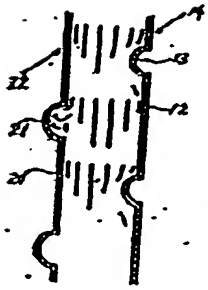
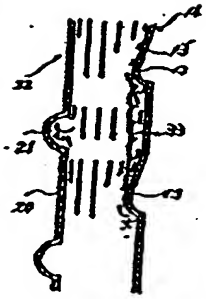


第 7 図



第 8 図